

**IN THE UNITED STATES DISTRICT COURT  
EASTERN DISTRICT OF MICHIGAN  
SOUTHERN DIVISION**

BEACON NAVIGATION GMBH,

Plaintiff,

v.

BAYERISCHE MOTOREN WERKE AG,  
BMW OF NORTH AMERICA, LLC, AND  
BMW MANUFACTURING CO., LLC,

Defendants.

Case No. 2:13-cv-11410-MAG-EAS

Hon. Mark A. Goldsmith  
Mag. Elizabeth A. Stafford

**OPINION AND ORDER GRANTING BMW’S MOTION FOR  
SUMMARY JUDGMENT OF NON-INFRINGEMENT (ECF No. 105)**

In this patent infringement case, plaintiff Beacon Navigation GmbH (“Beacon”) alleges that defendants Bayerische Motoren Werke AG, BMW of North America, LLC, and BMW Manufacturing Co., LLC (collectively, “BMW”) infringe a Beacon patent on vehicle navigation technology, U.S. Patent No. 5,862,511 (the “511 Patent”).

Presently before the Court is BMW’s motion for summary judgment of non-infringement. The parties have submitted written briefs explaining their positions on

the infringement issues in this case.<sup>1,2</sup> Pursuant to Local Rule 7.1(f)(2), the Court will decide BMW's motion for summary judgment of non-infringement without a hearing. E.D. Mich. LR 7.1(f)(2).

For the reasons stated in this opinion and order, the Court will **GRANT** BMW's motion for summary judgment of non-infringement.

## I. PROCEDURAL HISTORY

This case once belonged to a larger group of related patent infringement cases involving additional defendants and additional Beacon patents. The Court has previously set forth a detailed procedural history of these cases. ECF No. 88, PageID.4120-4122. Only this case against BMW, which now only involves the '511 Patent, remains pending. In summary, this case was filed by Beacon on October 11, 2011 in the United States District Court for the District of Delaware and transferred to this District on March 20, 2013. Beginning on August 12, 2013, the Court stayed this case pending a succession of proceedings in the United States Patent and Trademark Office (the "USPTO"). While ultimately cancelling the asserted claims of other Beacon patents, the USPTO issued four reexamination certificates

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<sup>1</sup> ECF Nos. 105, 109 \*SEALED\* ("BMW's Motion"); ECF Nos. 118, 121 \*SEALED\* ("Beacon's Opposition"); ECF Nos. 127, 129 \*SEALED\* ("BMW's Reply").

<sup>2</sup> *See also* ECF No. 133 \*SEALED\* ("BMW's Supplemental Brief"); ECF No. 137 \*SEALED\* ("Beacon's Supplemental Opposition"); ECF No. 139 \*SEALED\* ("BMW's Supplemental Reply").

confirming the novelty and non-obviousness of the asserted claims of the '511 Patent. *Ex Parte* Reexamination Certificate Nos. 5,862,511 C1, 5,862,511 C2, 5,862,511 C3, and 5,862,511 C4.

On August 19, 2022, following the conclusion of the last USPTO proceeding, the Court lifted the stay. On November 18, 2022, Beacon filed a first amended complaint ("FAC"), alleging that BMW infringes the '511 Patent. ECF No. 60. On December 2, 2022, BMW answered and counterclaimed for declaratory judgment, denying that it infringes the '511 Patent and alleging that the '511 Patent is invalid. ECF No. 62. On December 16, 2022, Beacon answered, denying that the '511 Patent is invalid. ECF No. 63.

In the FAC, Beacon alleges that BMW infringed Claims 1 and 3 of the '511 Patent in connection with sales of vehicles with GPS navigation systems (the "accused vehicles" and the "accused navigation systems") prior to the '511 Patent's December 28, 2015 expiration date. Beacon alleges that BMW directly infringed Claim 1 by making, importing, and selling the accused vehicles. ECF No. 60, PageID.3223-3224 (FAC ¶¶ 16-17). Beacon alleges that, with knowledge of the '511 Patent, BMW induced consumers to infringe Claim 3 by providing the accused vehicles along with instructions to use the accused navigation systems. ECF No. 60, PageID.3226 (FAC ¶¶ 22-24).

On July 28, 2023, the Court denied BMW's motion to dismiss Beacon's induced infringement claims. ECF No. 88. Additionally, the Court issued an opinion and order construing the disputed claim terms within the asserted claims of the '511 Patent, pursuant to *Markman v. Westview Instruments, Inc.*, 517 U.S. 370 (1996). ECF No. 87. On December 28, 2023, the Court denied BMW's motion for judgment on the pleadings that the asserted claims of the '511 Patent are invalid as patent ineligible. ECF No. 111.

On December 11, 2023, BMW filed its present motion for summary judgment of non-infringement, asking the Court for summary judgment of no direct infringement and summary judgment of no induced infringement under Federal Rule of Civil Procedure 56.

On December 28, 2023, during the pendency of BMW's present motion for summary judgment of non-infringement, the Court granted BMW leave to depose third-party Harman, BMW's supplier of the accused navigation systems. After the parties and Harman proceeded with conducting a deposition via written questions under Federal Rules of Civil Procedure 31 and 32, beginning on April 3, 2024, the parties submitted supplemental briefing based on the testimony of Harman's witness.

## II. '511 PATENT

The '511 Patent, entitled "Vehicle Navigation System and Method," was filed in the USPTO on December 28, 1995 and issued on January 19, 1999. The '511 Patent expired on December 28, 2015, twenty years after its filing date. *See* 35 U.S.C. § 154(a)(2).

The '511 Patent is directed to vehicle navigation technology. In the written description, the '511 Patent begins with a helpful background section on prior navigation systems. In general, to support a vehicle's navigation functionality, such as route guidance and turn-by-turn navigation, navigation systems work by continuously determining the vehicle's current position. To determine the current position, navigation systems use information from a Global Positioning System (GPS), motion sensors, and a map database. '511 Patent 1:16-2:25. In connection with these components, as the vehicle moves and the once-current position becomes a previous position, navigation systems can use different techniques to re-determine the current position. For example, a GPS position based on information from space-based satellites can be used for the current position. *Id.* 1:16-18. Alternatively, using "propagation" (also known as "dead reckoning") techniques, information from the motion sensors can be used to propagate the current position from the previous position. *Id.* 1:63-2:3. Moreover, using "map matching" techniques, information

from the motion sensors can be matched to a position in the map database, and the resulting map-matched position can be used for the current position. *Id.* 2:13-25.

The '511 Patent describes a navigation system that uses GPS velocity information to implement purportedly improved propagation techniques. *Id.* 2:32-3:13. Before turning to the disclosed propagation techniques, it is important to note that the '511 Patent assumes knowledge of math principles, two of which are relevant to the asserted claims. First, position and velocity are “vectors.” This means that, in addition to their distance and speed (i.e., magnitude) components, position and velocity have a heading (i.e., direction) component. Accordingly, map-matched positions have map headings, and GPS velocities have GPS headings, that point, for example, in the East and North directions. *Id.* 2:32-36, 7:67-8:3. Second, relevant to the disclosed propagation techniques, velocity can be “integrated” to obtain “displacements” (i.e., changes in position) in the directions of the heading. Accordingly, GPS velocities can be integrated to obtain displacements, which can then be applied to the previous position to obtain the current position. *Id.* 15:45-49, 15:58-63, 16:12-16.

In connection with the disclosed propagation techniques, Claims 1 and 3 of the '511 Patent are directed to an embodiment for updating GPS velocity information with a map heading. *Id.* 15:29-44, 15:53-16:22. As shown in Figure 7c, reproduced below, the embodiment involves steps for updating a GPS velocity vector (**200**) with

a map heading (**202**) for use in the propagation of a previous position (**191**) to a current position (**206**). *Id.* 15:53-65.

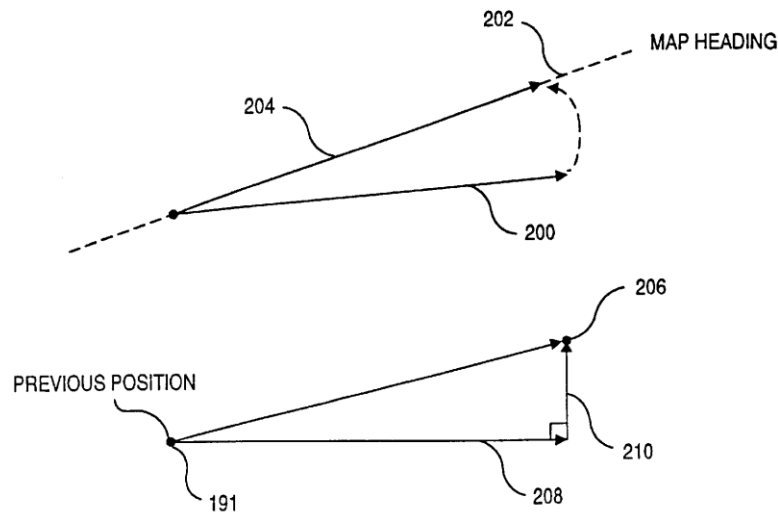


Fig-7c

The GPS velocity vector (**200**) has GPS speed and GPS heading components. *Id.* 2:32-36. The map heading (**202**) is based on the heading of the mapped path on which the vehicle is traveling. *Id.* 15:29-34. When the difference between the GPS heading and the map heading (**202**) is within a threshold, the GPS velocity vector (**200**) is rotated to align with the map heading (**202**). *Id.* 15:58-63. The rotated GPS velocity vector (**204**) is then integrated to obtain displacements (**208** and **210**). *Id.* The displacements (**208** and **210**) are then applied to the previous position (**191**) to obtain the current position (**206**). *Id.* 15:63-65.

Claim 1 recites the patented navigation system, and Claim 3 recites the patented navigation method:

1. An improved vehicle navigation system comprising:

a map database with map information, said vehicle navigation system derives a map heading from said map information; and

a GPS receiver which provides GPS velocity information including a heading, said vehicle navigation system uses said velocity information to propagate a previous position to a current position and interrogates said map database to obtain said map heading information; said vehicle navigation system updates said velocity information with said map heading for propagating said previous position to said current position if the difference between the heading of said velocity information and said map heading are within a threshold, wherein said system rotates said velocity to align with said map heading and integrates the rotated velocity to obtain displacements; said system obtains said current position by applying said displacements to said previous position.

3. A method of estimating the velocity of a vehicle known to be on a mapped path comprising:

determining the velocity of the vehicle, the velocity including a heading;

interrogating a map database to obtain a map heading of said mapped path; and

updating said velocity with said map heading if the difference between the heading of said velocity and said map heading are within a threshold;

using said velocity to propagate a previous position to a current position, wherein said step of using includes rotating velocity to align with said map heading and integrating rotated velocity to obtain a displacement and obtaining said current position by applying said displacement to said previous position.

*Id.* 17:11-29 (Claim 1), 17:48-63 (Claim 3).



As noted above, Claims 1 and 3 are directed to the embodiment shown in Figure 7c. Claim 1 recites a GPS receiver and a map database, and is otherwise directed to a navigation system that generally performs the steps recited in Claim 3.

At the claim construction stage of this case, before turning to the disputed claim terms, the Court adopted several agreed constructions. By agreement of the parties, “velocity” means “velocity vector, which includes speed and heading components.” Similarly, “GPS velocity information” means “information based on the speed and heading of the GPS receiver.” With respect to the rotate–then–integrate sequence, “rotates said velocity to align with said map heading” means “rotates the velocity vector to align with the map heading while maintaining the magnitude of the velocity vector,” and “integrates the rotated velocity to obtain displacements” means “calculates the integral of the rotated velocity to obtain displacements.” ECF No. 87, PageID.4090-4091.

As to the proper constructions of the disputed claim terms, the Court resolved the disputed issues of definiteness in Beacon’s favor and adopted Beacon’s proposed constructions. Among other things, the Court found that “current position” is not indefinite, and that “previous position” and “current position” should be given their plain and ordinary meanings. Similarly, the Court found that “propagating said previous position to said current position” is not indefinite, and should be given its plain and ordinary meaning. ECF No. 87, PageID.4092-4101 (current position term),

PageID.4101-4103 (propagation terms), PageID.4114-4116 (previous position term).

### **III. ACCUSED NAVIGATION SYSTEMS**

The infringement issues in this case center on the computer source code for the accused navigation systems. BMW makes the accused vehicles, but its supplier, Harman, makes the accused navigation systems, and holds the source code in confidence. During discovery, Harman made the source code available for inspection by the parties and their technical experts pursuant to a subpoena served by Beacon.

The parties do not raise any disputes over the general nature of the accused navigation systems. Similar to the navigation system of the '511 Patent, the accused navigation systems use information from a GPS, motion sensors, and a map database to perform dead reckoning and map matching. As part of the source code, the accused navigation systems include a Kalman filter. In connection with dead reckoning, the Kalman filter combines information from GPS and non-GPS components (also known as “sensor fusion”) to determine a number of “vehicle states.” Among other vehicle states, the Kalman filter determines the current dead reckoning position, as well as the current speed and heading.

BMW’s motion for summary judgment is directed to a corrected opening expert report from Beacon’s technical expert on infringement, Dr. Phillip Dafesh,

Ph.D. (“infringement report”), through which Beacon has disclosed its infringement theory in light of the source code. As explained below, in his infringement report, Dafesh focuses on various source code modules involved with map matching. Relevant to his infringement conclusions, Dafesh describes that the source code includes a “PositionFeedback” module which calls a “SetProbablePosition” module, and a “MatchAll” module which calls a “CalcFutureDrPosition” module.

The PositionFeedback module calls the SetProbablePosition module to provide map feedback to the Kalman filter. Additionally, the MatchAll module calls the CalcFutureDrPosition module to continue dead reckoning based on the vehicle states from the Kalman filter. Specifically, the CalcFutureDrPosition module uses the current speed and heading to propagate the current dead reckoning position to a predicted position one second in the future. The MatchAll module calls the CalcFutureDrPosition module because it then uses the predicted position to perform a probability analysis on potential map routes. *See generally* ECF No. 109-2 \*SEALED\*, PageID.6862-6864, 6866-6867, 6869-6871 (Dafesh Report ¶¶ 60, 66-68, 72-73, 78-82).

Dafesh concludes that the accused navigation systems practice the asserted claims because the source code performs the rotate–then–integrate sequence to propagate the current dead reckoning position to the predicted position. *Id.*, PageID.6859-6860 (Dafesh Report ¶ 43). As to rotation, Dafesh explains that the

map feedback to the Kalman filter causes the Kalman filter to update the vehicle states. In addition to a map position, the map feedback includes a map heading. *Id.*, PageID.6866-6867 (Dafesh Report ¶¶ 72-73). Based on the input of the map heading, the Kalman filter rotates the current heading to align with the map heading. As such, the post-map feedback current speed and heading output from the Kalman filter define a rotated velocity. Relatedly, the pre-map feedback current speed and heading output from the Kalman filter define the velocity that undergoes rotation. *See generally* ECF No. 109-3 \*SEALED\*, PageID.6919; ECF No. 116-3 \*SEALED\*, PageID.7357 (Dafesh Dep. Tr. 112:5-113:18). As to integration, Dafesh explains that the source code multiplies the rotated velocity by time to obtain displacements, and applies the displacements to the current dead reckoning position to obtain the predicted position. ECF No. 109-2 \*SEALED\*, PageID.6870-6871 (Dafesh Report ¶¶ 80-81). Assuming a once per second update rate typical of GPS receivers, multiplying by one second would yield displacements that simply have the components of the rotated velocity. *Id.*, PageID.6871 (Dafesh Report ¶ 82).

#### IV. LEGAL STANDARDS

“Summary judgment is as available in patent cases as in other areas of litigation.” *Cont’l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1265 (Fed. Cir. 1991).

### A. Summary Judgment

Under Federal Rule of Civil Procedure 56, summary judgment is proper when “there is no genuine dispute as to any material fact” and the moving party is “entitled to judgment as a matter of law.” Fed. R. Civ. P. 56(a). “In deciding a motion for summary judgment, the court must view the evidence in the light most favorable to the non-moving party, drawing all reasonable inferences in that party’s favor.” *Sagan v. United States*, 342 F.3d 493, 497 (6th Cir. 2003). “Where the moving party has carried its burden of showing that the pleadings, depositions, answers to interrogatories, admissions and affidavits in the record, construed favorably to the non-moving party, do not raise a genuine issue of material fact for trial, entry of summary judgment is appropriate.” *Gutierrez v. Lynch*, 826 F.2d 1534, 1536 (6th Cir. 1987) (citing *Celotex Corp. v. Catrett*, 477 U.S. 317, 322 (1986)).

The court does not weigh the evidence to determine the truth of the matter, but rather, to determine if the evidence produced creates a genuine issue for trial. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 249 (1986). The moving party discharges its burden by “‘showing’—that is, pointing out to the district court—that there is an absence of evidence to support the nonmoving party’s case.” *Horton v. Potter*, 369 F.3d 906, 909 (6th Cir. 2004) (quoting *Celotex*, 477 U.S. at 325).

The burden then shifts to the non-moving party, who “must do more than simply show that there is some metaphysical doubt as to the material facts.”

*Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 586 (1986). The non-moving party must put forth enough evidence to show that there exists “a genuine issue for trial.” *Horton*, 369 F.3d at 909 (citing *Matsushita*, 475 U.S. at 587). Summary judgment is not appropriate when “the evidence presents a sufficient disagreement to require submission to a jury.” *Anderson*, 477 U.S. at 251-52.

The existence of a factual dispute alone does not, however, defeat a properly supported motion for summary judgment—the disputed factual issue must be material. “The judge’s inquiry, therefore, unavoidably asks whether reasonable jurors could find by a preponderance of the evidence that the plaintiff is entitled to a verdict—whether there is evidence upon which a jury can properly proceed to find a verdict for the party producing it, upon whom the onus of proof is imposed.” *Id.* at 252 (quotation and alteration omitted). A fact is “material” for purposes of summary judgment when proof of that fact would establish or refute an essential element of the claim or a defense advanced by either party. *Kendall v. Hoover Co.*, 751 F.2d 171, 174 (6th Cir. 1984) (citation omitted).

## **B. Patent Infringement**

The Patent Act grants a patentee the right to exclude others from practicing the patented invention. 35 U.S.C. § 154(a)(1). Thus, whoever “without authority” makes, uses, offers to sell, sells, or imports the patented invention “infringes the patent.” *Id.* § 271(a). Infringement of a patent, “whether literal or under the doctrine

of equivalents, is a question of fact.” *Absolute Software, Inc. v. Stealth Signal, Inc.*, 659 F.3d 1121, 1129-30 (Fed. Cir. 2011). “Summary judgment of non-infringement is proper when no reasonable jury could find that every limitation recited in a properly construed claim is found in the accused device literally or under the doctrine of equivalents.” *Advanced Steel Recovery, LLC v. X-Body Equip., Inc.*, 808 F.3d 1313, 1317 (Fed. Cir. 2015). “Where ... the parties do not dispute any relevant facts regarding the accused product but disagree over which of two possible meanings of [a particular claim] is the proper one, the question of literal infringement collapses to one of claim construction and is thus amenable to summary judgment.” *Athletic Alternatives, Inc. v. Prince Mfg., Inc.*, 73 F.3d 1573, 1578 (Fed. Cir. 1996).

In this case, Beacon has not presented a theory of infringement under the doctrine of equivalents. The Court must therefore consider Beacon’s infringement theory in the context of literal infringement. In the literal infringement analysis, each and every limitation in a claim is “deemed material to defining the invention’s scope.” *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 18 (1997). “To establish literal infringement, every limitation set forth in a claim must be found in an accused product, exactly.” *Southwall Techs., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1575 (Fed. Cir. 1995). “If even one limitation is missing or not met as claimed, there is no literal infringement.” *WMS Gaming, Inc. v. Int’l Game Tech.*, 184 F.3d 1339, 1350 (Fed. Cir. 1999) (quotation and citation omitted).

## **V. INFRINGEMENT ANALYSIS**

Based on Beacon's infringement theory as disclosed through Dafesh's infringement report, BMW moves for summary judgment of no direct infringement on three grounds. First, with respect to the identified integration to obtain the displacements (i.e., multiplying the rotated velocity by time), BMW moves for summary judgment as to Claims 1 and 3 because the accused navigation systems do not use calculus integration, which BMW argues is required to calculate an integral under an agreed construction. Second, with respect to the identified velocity that undergoes rotation (i.e., the velocity defined by the pre-map feedback current speed and heading output from the Kalman filter), BMW moves for summary judgment as to Claim 1 because the accused navigation systems do not rotate a GPS velocity provided by the GPS receiver. Third, with respect to the identified propagation (i.e., propagating the current dead reckoning position to the predicted position one second in the future), BMW moves for summary judgment as to Claims 1 and 3 because the accused navigation systems do not propagate a previous position to a current position, and because they instead propagate to an expressly future position, no reasonable jury could find otherwise.

For the reasons set forth below, in light of the claim language of the asserted claims and the undisputed nature of the accused navigation systems, the Court finds that, on the whole, BMW is entitled to summary judgment of no direct infringement



in this case. Initially, the Court finds that BMW is not entitled to summary judgment as set forth in BMW's first ground because the '511 Patent does not support a calculus integration requirement. However, as to BMW's second ground, the Court finds that BMW is entitled to summary judgment that BMW does not infringe Claim 1 because there is no genuine dispute that the accused navigation systems do not rotate a GPS velocity provided by the GPS receiver. Furthermore, as to BMW's third ground, the Court finds that BMW is entitled to summary judgment that BMW does not infringe Claim 1 and that customers do not infringe Claim 3 because there is no genuine dispute that the accused navigation systems do not propagate a previous position to a current position.

**A. Calculating an Integral (Claims 1 and 3)**

BMW's first ground for summary judgment of non-infringement is directed to the math performed by the accused navigation systems. As part of the claim language directed to using the initial velocity to "propagate a previous position to a current position," Claims 1 and 3 include similar "rotates/integrates/obtains" and "rotating/integrating/obtaining" limitations. In the *Markman* decision, the Court adopted an agreed construction of "integrates the rotated velocity to obtain displacements" in Claim 1 and "integrating rotated velocity to obtain a displacement" in Claim 3. Under the agreed construction, in relevant part, "integrates/integrating" the rotated velocity means "calculates/calculating the

integral of” the rotated velocity. ECF No. 87, PageID.4091. Stated in shorthand, the agreed construction of “integrating” is “calculating an integral.”

As noted above, the ’511 Patent assumes knowledge of math principles. In the written description, the ’511 Patent describes that the navigation system uses various equations to implement the disclosed propagation techniques. ’511 Patent 6:32-43, 8:51-11:20, 13:28-15:7. The ’511 Patent provides two propagation equations which the parties and their technical experts categorize as a calculus equation and a kinematic equation. The propagation equations have parallel terms involving the relationship between position (x), velocity (v), and acceleration (a) with respect to time (t). In simplified forms, the calculus equation is:

$$\text{current } x = \text{previous } x + \int v \, dt + \iint a \, dt;$$

and the kinematic equation is:

$$\text{current } x = \text{previous } x + v * \Delta t + 1/2 * a * \Delta t^2.$$

As to the terms for using velocity to obtain displacements, the ’511 Patent describes the one in the calculus equation (i.e.,  $\int v \, dt$ ) as “the integral of velocity” and the one in the kinematic equation (i.e.,  $v * \Delta t$ ) as “the GPS velocity (vector) times the delta time.” *Id.* 9:51-62 (calculus equation), 10:35-50 (kinematic equation).

According to Beacon’s infringement theory, the rotated velocity used by the accused navigation systems for propagation is defined by the post-map feedback current speed and heading output from the Kalman filter. To obtain the

displacements, the accused navigation systems multiply the rotated velocity by time. For a once per second update rate, multiplying by one second would yield displacements that simply have the components of the rotated velocity.

### **1. Arguments**

In its motion, BMW points out that the accused navigation systems use multiplication to obtain the displacements (i.e., like the kinematic equation). With respect to the agreed construction of “integrating,” however, BMW reads “calculating an integral” as requiring calculus integration (i.e., like the calculus equation). BMW’s basic contention is that a person of ordinary skill in the art would know from their math classes that an “integral” is a specific calculus concept whose solution requires specific calculus techniques. Against the background where the ’511 Patent provides a calculus equation, BMW argues that they would understand that “calculating an integral” requires calculus integration. Because the accused navigation systems do not use calculus integration, and instead use an approximation, BMW argues that summary judgment is appropriate.

In opposition, Beacon represents that neither party ever agreed to a calculus integration requirement. Beacon reads “calculating an integral” as referring to calculus integration but not to the exclusion of using non-calculus techniques to approximate the solution. Beacon’s basic contention is that a person of ordinary skill in the art would know from their experience with navigation systems that calculus

integration works in theory for textbook continuous functions but not in practice for information input at discrete time intervals. Against the background where the '511 Patent provides a kinematics equation, Beacon argues that they would understand that “calculating an integral” includes the real-world version of multiplying by time. Because the accused navigation systems use the real-world version of calculus integration, Beacon argues that summary judgment is not appropriate.

## 2. Analysis

As to BMW's first ground, the Court finds that BMW is not entitled to summary judgment of no direct infringement. As presented by the parties in light of the undisputed nature of the accused navigation systems, the question for the Court is whether the '511 Patent supports a calculus integration requirement. Specifically, the question is whether, to calculate an integral, the '511 Patent requires calculus integration (i.e., like the calculus equation), to the exclusion of multiplication (i.e., like the kinematic equation). In the written briefs, the parties present lengthy arguments for and against a calculus integration requirement. In support of their arguments, the parties cite extensive extrinsic evidence including testimony from their technical experts, as well as math dictionaries and math textbooks. ECF No. 109 \*SEALED\*, PageID.6847-6849 (BMW's Mot. 19-21); ECF No. 121 \*SEALED\*, PageID.8286-8290 (Beacon's Opp'n 12-16). Rather than the extrinsic evidence, the Court will begin by considering the '511 Patent itself. *Phillips v. AWH*

*Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005) (*en banc*) (explaining that “the best source for understanding a technical term is the specification from which it arose, informed, as needed, by the prosecution history”) (quotation omitted).

To the extent “calculating an integral” in the agreed construction refers to calculus integration, the ’511 Patent plainly does not exclude the use of non-calculus techniques such as multiplying by time to approximate the solution. As to the ’511 Patent, BMW’s argument for a calculus integration requirement rests entirely on the difference between the two propagation equations for establishing what is and what is not “calculating an integral.” ECF No. 109 \*SEALED\*, PageID.6847 (BMW’s Mot. 19) (BMW arguing that “the ’511 Patent provides specific equations for calculating the integral of vectors”). As set forth above, the ’511 Patent does describe the parallel terms for using velocity to obtain displacements as “the integral of velocity” in the calculus equation and as “the GPS velocity (vector) times the delta time” in the kinematic equation. ’511 Patent 9:51-62 (calculus equation), 10:35-50 (kinematic equation). Elsewhere, however, the ’511 Patent clearly suggests that the different categories of math are interchangeable to the concept of calculating an integral.

With respect to the embodiment shown in Figure 7c, to which Claims 1 and 3 are directed, the ’511 Patent states that the navigation system “integrates” the rotated GPS velocity vector to obtain the displacements. ’511 Patent 15:58-63. In the

immediately preceding section on propagation equations, the '511 Patent provides that “to calculate [the] displacements,” the navigation system uses kinematic equations in which the components of the GPS velocity vector are multiplied by time. *Id.* 13:59-64 (equations 3 and 4). Moreover, in showing parallel terms for using acceleration to obtain displacements, one in a calculus equation and one in a kinematic equation, the '511 Patent describes them identically as the “double integra[l/tion]” of acceleration. *Id.* 9:51-62 (calculus equation), 10:66-11:5 (kinematic equation). Similarly, in explaining how the output of an accelerometer is used to calculate a velocity, the '511 Patent parenthetically refers to an acceleration that was “multiplied by the delta time” as having been “integrated once.” *Id.* 7:11-14.

Given these teachings, the Court finds that the '511 Patent does not support a calculus integration requirement. Conversely, the Court need not address the contradictory extrinsic evidence BMW urges the Court to consider to reach the opposite conclusion that “calculating an integral” cannot involve anything resembling an approximation. Having considered the written briefs and the relevant evidence of record, the Court concludes that, at minimum, there is a genuine dispute whether the accused navigation systems calculate the integral of the rotated velocity to obtain the displacements. Accordingly, the Court finds that BMW is not entitled

to summary judgment that BMW does not infringe Claim 1 or that customers do not infringe Claim 3.

### **B. Rotating a GPS Velocity (Claim 1)**

BMW's second ground for summary judgment of non-infringement is directed to Claim 1 and concerns how the accused navigation systems use the Kalman filter to combine information from GPS and non-GPS components. In the *Markman* decision, the Court adopted an agreed construction of "GPS velocity information" in Claim 1. Under the agreed construction, the term means "information based on the speed and heading of the GPS receiver." ECF No. 87, PageID.4090. The term first appears in the claim language reciting "a GPS receiver which provides GPS velocity information" and is afterward referenced throughout Claim 1:

\* \* \*

a GPS receiver which provides **GPS velocity information** including a heading, said vehicle navigation system uses **said velocity information** to propagate a previous position to a current position and interrogates said map database to obtain said map heading information; said vehicle navigation system updates **said velocity information** with said map heading for propagating said previous position to said current position if the difference between the heading of **said velocity information** and said map heading are within a threshold, wherein said system rotates **said velocity** to align with said map heading and integrates the rotated velocity to obtain displacements; said system obtains said current position by applying said displacements to said previous position.

'511 Patent 17:11-29 (emphasis added). As recited in Claim 1, the claim language is directed to the way the navigation system uses “said velocity information” for propagation. Relevant to BMW’s second ground, the claim language recites that the navigation system rotates “said velocity” to align with the map heading from the map database.

According to Beacon’s infringement theory, in the accused navigation systems, the velocity that undergoes rotation is defined by the pre-map feedback current speed and heading output from the Kalman filter. BMW explains that the parties and their technical experts agree that the Kalman filter combines information from a GPS receiver and motion sensors (also known as “sensor fusion”) to determine the current speed and heading. ECF No. 109 \*SEALED\*, PageID.6849-6850 (BMW’s Mot. 21-22). Compared to a GPS velocity provided by the GPS receiver, the accused navigation systems rotate a changed, and therefore different, velocity. *Id.* PageID.6850 (BMW’s Mot. 22).

### **1. Arguments**

In its motion, BMW does not move for summary judgment as to Claim 3, whose claim language does not impose any particular limitations on the initial velocity. However, BMW moves for summary judgment as to Claim 1 because the claim language recites that the navigation system rotates “said velocity” which the GPS receiver “provides.” Because the accused navigation systems do not rotate a



GPS velocity provided by the GPS receiver, BMW argues that summary judgment is appropriate.

In opposition, Beacon does not dispute that the accused navigation systems rotate a different velocity. However, Beacon cites the agreed construction to argue that the velocity still qualifies as “GPS velocity information.” Beacon argues that summary judgment is not appropriate because the accused navigation systems rotate a velocity whose current speed and heading are, under the agreed construction, “based on” the speed and heading of the GPS receiver.

## **2. Analysis**

As to BMW’s second ground, the Court finds that BMW is entitled to summary judgment of no direct infringement. As explained below, the Court reaches two conclusions in its infringement analysis. First, with respect to the “said velocity” limitation, the claim language of Claim 1 imposes a “same velocity” requirement, which precludes a finding of infringement in light of the undisputed facts of this case. Second, in view of the “said velocity” limitation, the infringement analysis does not turn on the meaning of “GPS velocity information.”

In Claim 1, after reciting “a GPS receiver which provides GPS velocity information,” the claim language recites that the navigation system rotates “said velocity” to align with the map heading from the map database. As explained by the Federal Circuit, instances of “said” (or “the”) in the claims of a patent “are anaphoric

phrases, referring to the initial antecedent phrase.” *Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1343 (Fed. Cir. 2008). Here, it is apparent that the original antecedent basis for “said velocity” is “GPS velocity information.” Accordingly, the Court finds that, in reciting that the navigation system rotates “said velocity” which the GPS receiver “provides,” the claim language imposes a “same velocity” requirement. As set forth above, because they use the Kalman filter to combine information from GPS and non-GPS components, the accused navigation systems rotate a different velocity compared to a GPS velocity from the GPS receiver. Accordingly, in light of the undisputed nature of the accused navigation systems, the Court finds that the claim language of Claim 1 precludes a finding of infringement.

As noted above, Beacon does not dispute that the accused navigation systems rotate a different velocity. However, Beacon argues that summary judgment is not appropriate because the velocity still qualifies as “GPS velocity information.” Beacon’s argument refers to the agreed construction of “GPS velocity information,” under which the term means “information based on the speed and heading of the GPS receiver.” With respect to the velocity that undergoes rotation, Beacon explains that the Kalman filter does not “destroy” a GPS velocity from the GPS receiver. ECF No. 121 \*SEALED\*, PageID.8290 (Beacon’s Opp’n 16). Rather, the current speed and heading are “derived, at least in part, from” a GPS speed and a GPS heading.

*Id.*, PageID.8291 (Beacon’s Opp’n 17). Put in terms of the agreed construction, Beacon argues that the accused navigation systems rotate a velocity whose current speed and heading are “based on” the speed and heading of the GPS receiver. *Id.* Basically, Beacon relies on the “based on” language in the agreed construction of “GPS velocity information” for broad coverage of partially GPS-derived velocities. *Id.*, PageID.8290 (Beacon’s Opp’n 16).

However, the infringement analysis does not turn on the meaning of “GPS velocity information,” or any reading of the agreed construction of the term. Accepting Beacon’s reading of the agreed construction would at most create a genuine dispute whether the different velocity might nonetheless qualify as “GPS velocity information” in its own right. But what ultimately precludes a finding of infringement is the “said velocity” limitation, not the “GPS velocity information” limitation. In connection with the Kalman filter, the issue is that the velocity that undergoes rotation is not just different, but changed, compared to a GPS velocity from the GPS receiver. Assuming, *arguendo*, that they rotate “GPS velocity information” under the agreed construction, the accused navigation systems do not, in accordance with the claim language, rotate “said velocity” which the GPS receiver “provides.”

In any event, Beacon does not identify any support in the ’511 Patent for its reading of the agreed construction of “GPS velocity information.” Together with the

claim language, the agreed construction recites “a GPS receiver which provides [information based on the speed and heading of the GPS receiver].” As explained throughout the ’511 Patent, the “present invention” relates to an “improved” navigation system that uses information from a GPS “to obtain velocity vectors, which include speed and heading components.” ’511 Patent Abstract, 1:5-12, 2:32-36. The agreed construction merely clarifies that a GPS velocity vector has both GPS speed and GPS heading components. On the other hand, while “GPS velocity information” is “based on” the GPS receiver’s speed and heading, it does not follow that every velocity “based on” the GPS receiver’s speed and heading is “GPS velocity information.” In fact, in the written description, the ’511 Patent distinguishes embodiments that use “GPS velocity information” from a variety of other embodiments whose velocity vectors are assembled from “several sources” of information. *Id.* 6:27-63. Contrary to Beacon’s reading of the agreed construction, the distinguished embodiments include one where “all raw inputs” from the GPS receiver and the motion sensors “go into a Kalmann [*sic*] filter arrangement.” *Id.* 6:61-63. *See also id.* 15:34-44 (distinguishing embodiments using a GPS heading from embodiments using a heading from the motion sensors or a Kalman filter), 16:19-22 (distinguishing embodiments using only GPS from embodiments using a combination of GPS and non-GPS components).

In summary, having considered the written briefs and the evidence of record, the Court concludes that there is no genuine dispute that the accused navigation systems do not rotate a GPS velocity provided by the GPS receiver. What ultimately precludes a finding of infringement is the “said velocity” limitation, regardless of the meaning of “GPS velocity information,” or any reading of the agreed construction of the term. Accordingly, the Court finds that BMW is entitled to summary judgment that BMW does not infringe Claim 1.

**C. Propagating to a Current Position (Claims 1 and 3)**

BMW’s third ground for summary judgment of non-infringement raises the issue of whether a future position can be considered as a current position in the context of navigation systems. The term “current position” and the related term “previous position” appear throughout the asserted claims. As recited in Claims 1 and 3, the claim language is directed to using the initial velocity to “propagate a previous position to a current position.” According to Beacon’s infringement theory, the accused navigation systems propagate the current dead reckoning position to the predicted position one second in the future. In the express words of the source code, they propagate a current position to a future position, not a previous position to a current position as required by the claim language.

In the *Markman* decision, the Court found that the intrinsic evidence does not define “current position” or otherwise reveal that the term has a special definition

other than its ordinary meaning. ECF No. 87, PageID.4100. Together with Beacon's proposed construction of "previous position," the Court adopted Beacon's proposed construction of "current position" and gave the term its plain and ordinary meaning. *Id.*, PageID.4092-4101. The Court noted BMW's concern with Beacon's silence on the ordinary meaning of "current position," but agreed with Beacon that no construction was necessary because the term by all appearances is easily understandable. *Id.*, PageID.4100. As Beacon put it, the term "consists of two simple English words" and "there is no need to conjure synonyms for them." ECF No. 78, PageID.3992.

### **1. Arguments**

In its motion, BMW argues that summary judgment is appropriate because the accused navigation systems do not propagate a previous position to a current position. Because they instead propagate to an expressly future position, BMW argues that no reasonable jury applying the plain and ordinary meaning of "current position" could find otherwise.

In opposition, Beacon argues that the Court should reject BMW's summary judgment argument as semantic. Citing deposition testimony from the technical experts of both parties, Beacon describes that navigation systems work by inputting information and determining positions at discrete time intervals called "epochs." The basic concept is that the previous epoch ends and the current epoch begins upon the

input of new information for determining the new current position. ECF No. 121 \*SEALED\*, PageID.8292-8293 (Beacon's Opp'n 18-19). According to Beacon, any position determined during the current "time period of interest" is a current position. *Id.*, PageID.8292 (Beacon's Opp'n 18). As a real-world example, Beacon points to a moving vehicle whose navigation system has a once per second update rate. Beacon explains that it would be wrong to say that a current position is really a previous position just because it technically measures where the vehicle was a few milliseconds ago. *Id.*, PageID.8293 (Beacon's Opp'n 19). Against the context of navigation systems, Beacon argues that summary judgment is not appropriate because it creates a genuine dispute whether the predicted position can be considered as a current position.

## **2. Analysis**

As to BMW's third ground, the Court finds that BMW is entitled to summary judgment of no direct infringement. As set forth above, in connection with dead reckoning, the accused navigation systems use the Kalman filter to determine the current dead reckoning position. Separately, in connection with map matching, the accused navigation systems use the predicted position one second in the future to perform a probability analysis on potential map routes.

With due regard to the way navigation systems work, Beacon's context-based opposition argument is a red herring. Applying Beacon's real-world example to the

accused navigation systems, the semantic argument would be that the current dead reckoning position is really a previous position. By contrast, the predicted position is for all intents and purposes a future position. As BMW points out in its supplemental brief, Harman's witness has testified that the predicted position "has nothing to do with" propagating a previous position to a current position. ECF No. 133 \*SEALED\*, PageID.8708 (BMW's Suppl. Br. 4). Rather, the predicted position is "not expected to be true" and gets "forgotten" after being used to perform a probability analysis on potential map routes. *Id.*, PageID.8706, 8708 (BMW's Suppl. Br. 2, 4). When the future time becomes the current time, the accused navigation systems "will in no way rely on" the predicted position to determine the new current dead reckoning position. *Id.*, PageID.8708 (BMW's Suppl. Br. 4).

Having considered the written briefs and the evidence of record, the Court concludes that there is no genuine dispute that the accused navigation systems do not propagate a previous position to a current position. Rather than showing that the accused navigation systems propagate to a current position, Beacon has shown that they instead propagate to an expressly future position. Given the commonly understood difference between previous, current, and future times, the Court finds that no reasonable jury applying the plain and ordinary meaning of "current position" could find that the predicted position one second in the future is a current position.



Accordingly, the Court finds that BMW is entitled to summary judgment that BMW does not infringe Claim 1 and that customers do not infringe Claim 3.

#### **D. Induced Infringement (Claim 3)**

In addition to moving for summary judgment of no direct infringement, BMW moves for summary judgment of no induced infringement as to Claim 3. The Patent Act codifies theories of liability for indirect infringement in Sections 271(b) and 271(c). Under Section 271(b), whoever “actively induces” infringement is “liable as an infringer.” 35 U.S.C. § 271(b). Induced infringement requires an underlying act of direct infringement by another party. *Joy Techs., Inc. v. Flakt, Inc.*, 6 F.3d 770, 774 (Fed. Cir. 1993). To prove direct infringement, the patentee must either point to specific instances of direct infringement or show that the accused product necessarily infringes. *Dynacore Holdings Corp. v. U.S. Philips Corp.*, 363 F.3d 1263, 1275-76 (Fed. Cir. 2004). In addition to underlying direct infringement, indirect infringement requires knowledge of the patent and knowledge of infringement. *Commil USA, LLC v. Cisco Sys., Inc.*, 575 U.S. 632, 639 (2015). As opposed to knowledge of the acts that constitute infringement, induced infringement requires “knowledge that the induced acts constitute patent infringement.” *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 766 (2011). Liability for induced infringement is premised on intent. “Inducement requires a showing that the alleged inducer knew of the patent, knowingly induced the infringing acts, and possessed a

specific intent to encourage another's infringement of the patent.” *Vita-Mix Corp. v. Basic Holding, Inc.*, 581 F.3d 1317, 1328 (Fed. Cir. 2009) (citing *DSU Med. Corp. v. JMS Co. Ltd.*, 471 F.3d 1293, 1304 (Fed. Cir. 2006) (*en banc* in relevant part)). “Thus, a person infringes by actively and *knowingly* aiding and abetting another's direct infringement.” *Water Techs. Corp. v. Calco, Ltd.*, 850 F.2d 660, 668 (Fed. Cir. 1988). “While proof of intent is necessary, direct evidence is not required; rather, circumstantial evidence may suffice.” *Id.*

In its motion, as one ground, BMW moves for summary judgment because Beacon has not shown direct infringement by customers. As another ground, BMW moves for summary judgment because Beacon has not come forward with direct evidence that any customers have used the accused navigation systems. As yet another ground, BMW moves for summary judgment because Beacon cannot show that BMW had knowledge of infringement, therefore precluding a finding of intent to encourage infringement.

For the same reasons set forth above, the Court finds that BMW is entitled to summary judgment of no induced infringement. Specifically, having found that BMW is entitled to summary judgment that customers do not infringe Claim 3, the Court necessarily finds that Beacon has not shown direct infringement by customers. *Joy Techs.*, 6 F.3d at 774 (explaining that indirect infringement requires an underlying act of direct infringement by a third party). Having found that BMW is

entitled to summary judgment on this ground, the Court need not reach the issues of whether BMW is entitled to summary judgment on the remaining grounds.

## **VI. CONCLUSION**

For the reasons stated in this opinion and order, the Court will **GRANT** BMW's motion for summary judgment of non-infringement.

SO ORDERED.

Dated: September 18, 2024  
Detroit, Michigan

s/Mark A. Goldsmith  
MARK A. GOLDSMITH  
United States District Judge